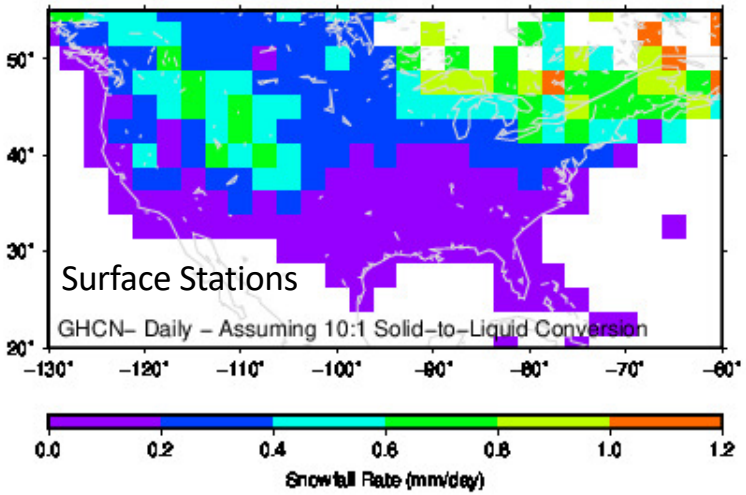
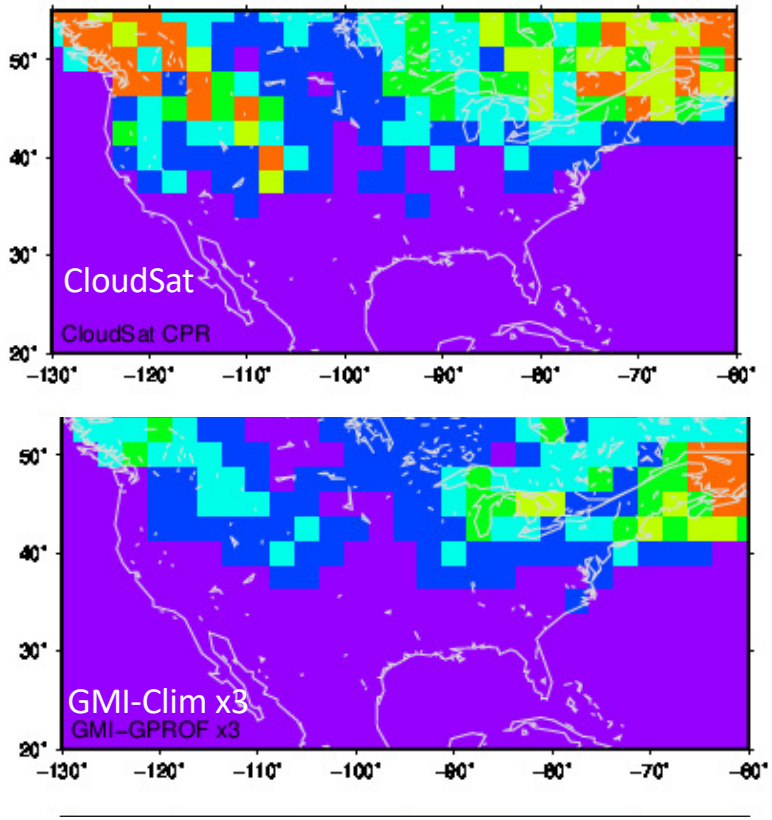
# Issues to Consider for Snowfall Retrieval

- Can we come up a consensus "snowfall climatology" at several regions over the globe, so that we know our retrievals are in the "ballpark" ?
  - CONUS, Japan/Korea, Finland
- Database:
  - Add profiles from CloudSat?
  - More research on "simulating" TBs using RT models?
- How to handle liquid-in-snowing-cloud problems?

# Multi-Year Snowfall in CONUS



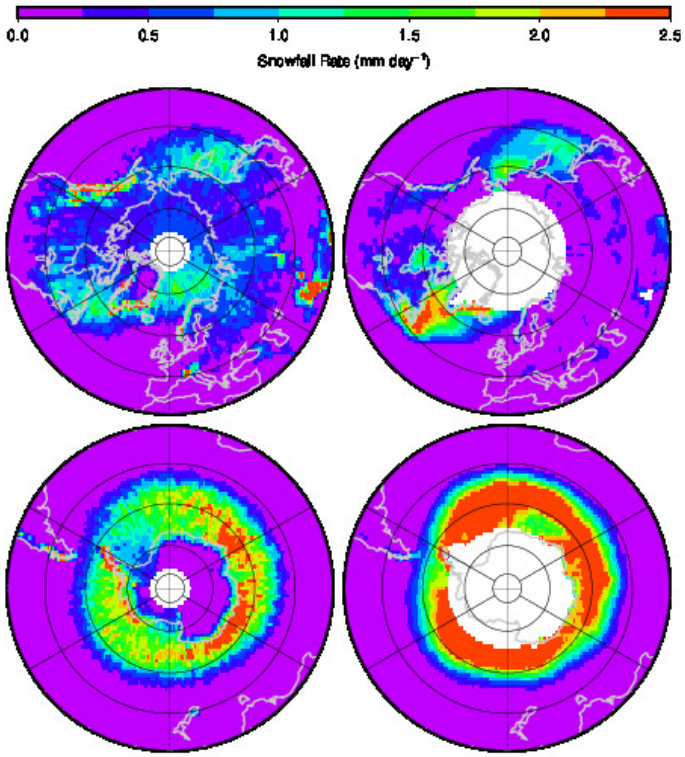




Similar distribution patterns, but quantitatively still far apart.

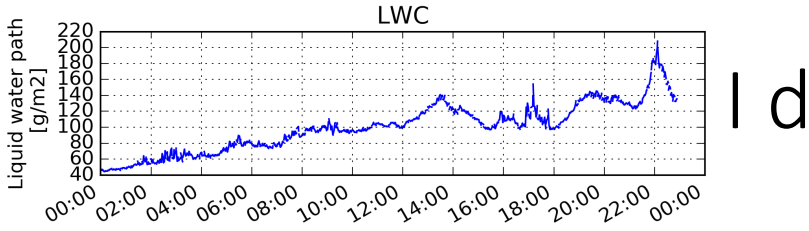
- Need high quality surface in situ measurements - What are available?)

# CloudSat vs. GMI Snowfall – Multi-year Global

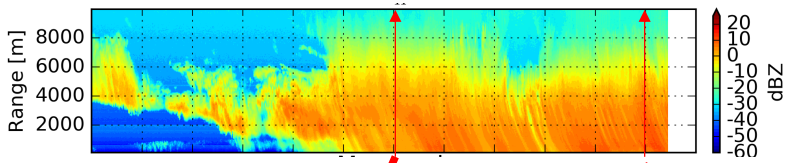
CloudSat (4 years)

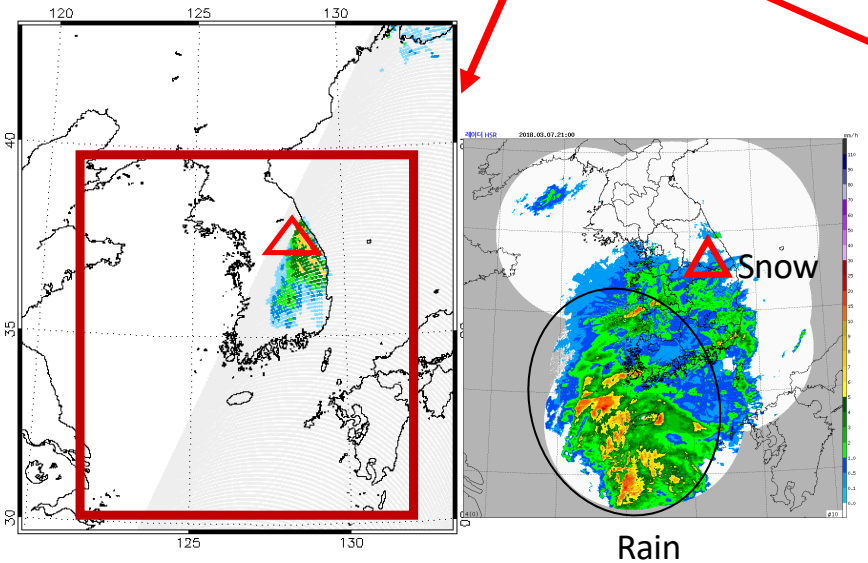


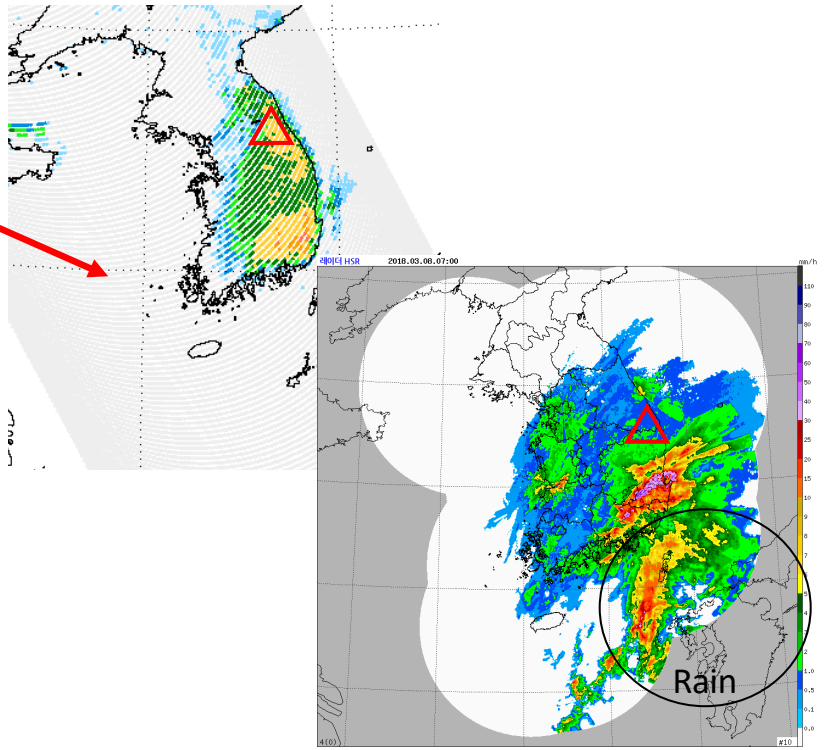

GMI (5 years) x 3

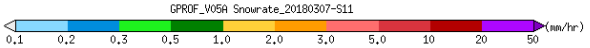

LWC
Liquid water path [g/m2]
220
200
180
160
140
120
100
80
60
40
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00

# I does well

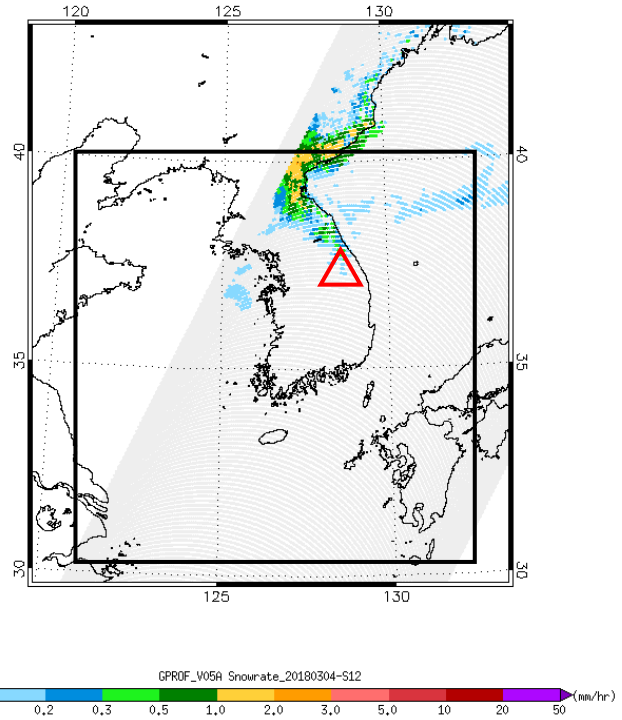

Range [m]
8000
6000
4000
2000
20
10
0
-10
-20
-30
-40
-50
-60
dBZ

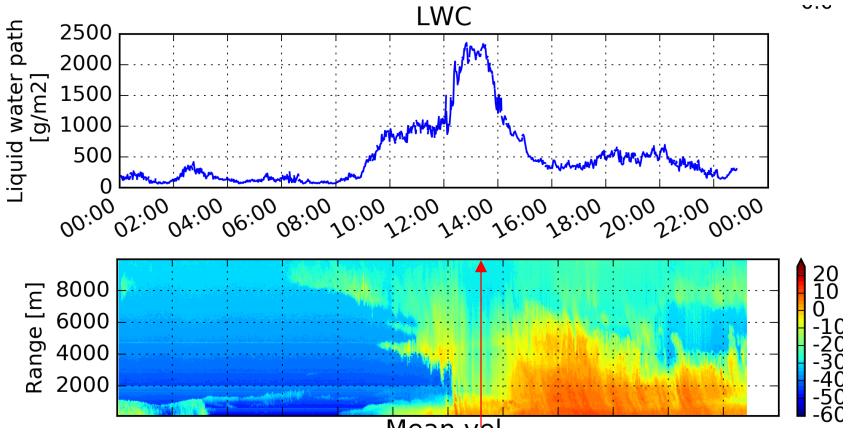

120
125
130
40
35
30
125
130
Snow
Rain

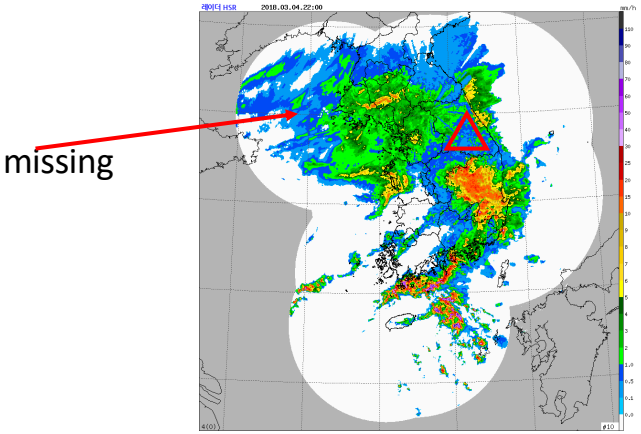

Rain


GPROF_V05A Snowrate_20180307-S11
0.1
0.2
0.3
0.5
1.0
2.0
3.0
5.0
10
20
50
(mm/hr)

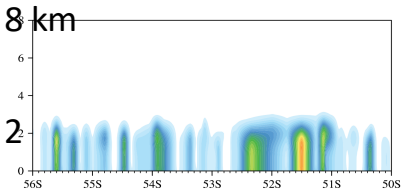
# Cases

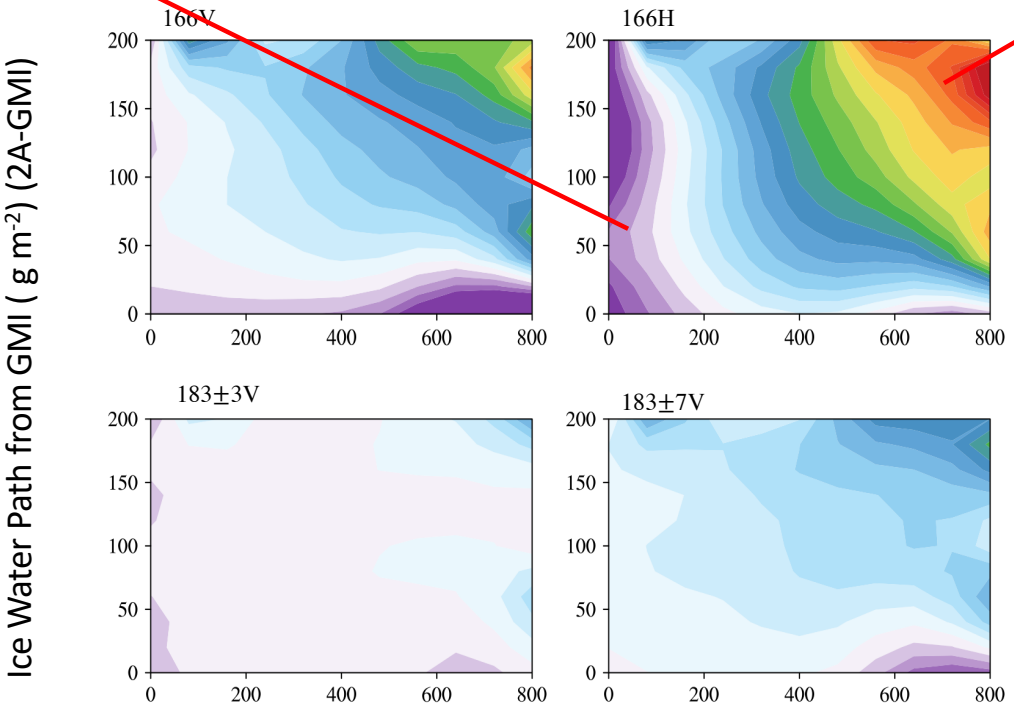

120
125
130
40
35
30
GPROF_V05A Snowrate_20180304-S12
0.1
0.2
0.3
0.5
1.0
2.0
3.0
5.0
10
20
50
(mm/hr)

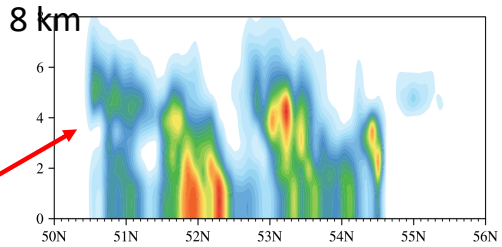

LWC
Liquid water path [g/m2]
2500
2000
1500
1000
500
0
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
00:00
Range [m]
8000
6000
4000
2000
20
10
0


missing

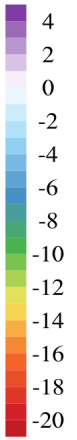
# When are RT models having problems in simulating GMI TBs?



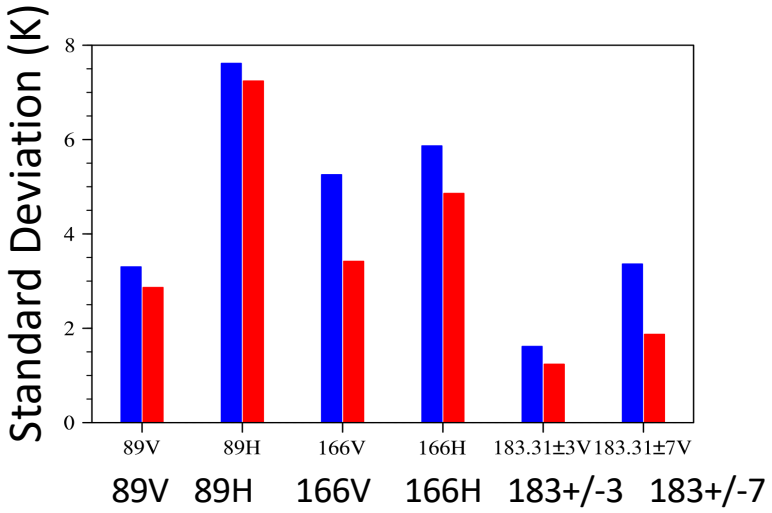



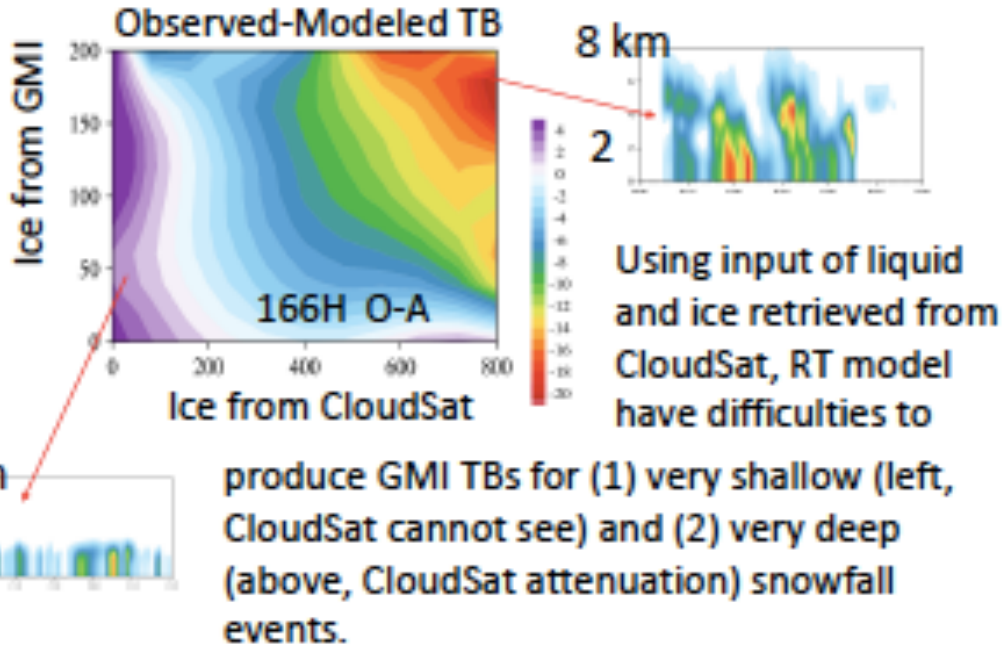

Observed – Simulated TB (K)




Over Ocean Only

How good can we simulate GMI brightness temperature for snowing clouds (under relatively well-known surface – ocean)




Using input of liquid and ice retrieved from CloudSat, RT model have difficulties to produce GMI TBs for (1) very shallow (left, CloudSat cannot see) and (2) very deep (above, CloudSat attenuation) snowfall events.

# Validation of GPM Snowfall Retrievals

- Validate the step to determine whether it is rain or snow (the probability/fraction of snow)
  - How does it relate to reanalysis data to be used?
  - Precipitation phase aloft (DPR algorithm) vs. at surface (T2m …)
- Validation by comparing long-term mean/large-scale pattern
  - CONUS – MRMS, Surface Stations, CloudSat …
  - Other Regions – Japan, S. Korea, Europe
- Physical Validations
  - Case studies
  - How good can we simulate GMI brightness temperature for snowing clouds (under relatively well known surface – ocean)